Determining the Carbon, Hydrogen, Nitrogen, Oxygen, and Sulfur content of unknowns is one of the most basic and essential needs for any chemist.

If you measure CHN/O/S, then you can increase productivity and maximize confidence in your results with the CE 440 Elemental Analyzer. The CE 440 is designed to give you accurate, reliable results, no matter what sample types you analyze.

The CE 440 uses thermal conductivity detection for measuring carbon, hydrogen, and nitrogen, after combustion and reduction. This time-proven technique allows measurements to be made over a very wide range of concentrations.
An IBM-compatible PC controls all instrument functions and simplifies operation for consistent operator-to operator results.

Only the CE 440 offers you all these advantages:

Accuracy and Precision - The CE440 provides analytical data of unsurpassed accuracy and precision. The complete control of combustion parameters combined with steady state measurement of combustion products ensures a level of accuracy and precision that cannot be matched.

Sample Run	%C	%H	%N
1	65.43	6.72	8.45
2	65.47	6.73	8.45
3	65.47	6.72	8.48
4	65.45	6.70	8.44
5	65.44	6.72	8.47
6	65.50	6.72	8.52
7	65.52	6.70	8.52
8	65.48	6.70	8.49
9	65.45	6.70	8.48
10	65.49	6.71	8.48
Mean Values	**65.47**	**6.71**	**8.48**
Theoretical Values	**65.44**	**6.71**	**8.45**
Deviation from Theory	**0.03**	**0.00**	**0.03**

Versatility - With its unique combination of both static and dynamic combustion, the CE 440 can combust the widest range of sample types of any CHN/O/S instrument.

Our unique horizontal furnace allows for automatic removal of the residue from each sample after analysis, avoiding memory effects and gas flow problems, which can occur with vertical furnace systems.

       Reliability - The CE440 is a fully automated CHN/O/S elemental analyzer. The system with its Windows™ based P.C. operating software has been designed to reduce human error through incorporation of extensive automation, customer help, and diagnostic facilities. Using the technique of steady-state measurement of combustion products, the CE 440 is inherently more reliable than gas chromatographic systems which are dependent on flow, column temperature, and dead volume management.

With the lowest operating cost of any elemental analyzer available, the CE 440 won't strain your budget. Low gas and reagent consumption combined with higher reduction tube life make it the most economical CHN/O/S elemental analyzer to operate.

Continuous diagnostics and automatic maintenance alerts make operation almost fool-proof. By monitoring signals, voltages, and sample throughput, the instrument provides you with continuous status reports on consumable reagents as well as an immediate warning should a problem occur. And, most parts are user-replaceable, further reducing cost and downtime.

CE440 Features

■ Rapid analysis for high productivity - analysis time of less than 5 minutes

■ Unique combustion technique makes it possible to analyze any sample type, from volatiles to refractories

■ Stable thermal conductivity detector provides linear response with superior precision and accuracy

■ Windows^R software with data storage for statistical analysis and flexible report generation

■ Horizontal sample injection removes interfering residue between each sample run

■ Continuous diagnostics with automatic maintenance alerts

■ Low reagent consumption - industry's lowest cost per sample

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Widest Range of Applications

With its wide linear range, combined static/dynamic combustion and unique horizontal furnace design allowing for the removal of sample residue between runs, the CE 440 is capable of analyzing the widest range of sample types - quickly, easily, and reliably. Typical applications include:

Organics and Pharmaceuticals - The CE 440 can analyze virtually any class of organics, including organometallics, heterocyclic nitrogen derivatives, steroids, polynuclear aromatics, and organophosphorous.

Environmental - Analyze the effects of fuels, oils, and their by-products on the environment, or study the composition of material retained by membranes used in oceanography, water filtration, and air monitoring.

Polymers - The CE 440 provides a fast, direct method for determining elemental composition of polymers, copolymers, and blends. Even samples with high levels of halogens, like PVC or Teflon^R , can be analyzed rapidly and accurately.

Refractories - Nitrides, graphite fibers, and ceramics are easily analyzed - even carbides with melting points over 2000°C.

Volatile/Air Sensitive Samples - Volatile and air sensitive materials are easily analyzed using our capsule sealing device.

Other Application Areas: Plastics, petrochemicals, agriculture, food, and pyrotechnical compounds.

Options to extend your capabilities

In addition to the automatic sample changer, Exeter Analytical, Inc. offers several other accessories to customize your system for your particular requirements:

■ **Single Sample Automation** - If you only run a few samples at a time, this feature will let you manually introduce a sample, then it will run the analysis automatically.
■ **Capsule Sealer** - This device ensures sample integrity by making a cold weld of the sample capsules. Analyzing highly volatile samples such as gasoline and oils becomes routine.
■ **Refractory Materials Kit** - This kit contains fluxes and special sleeves for the combustion of difficult samples requiring rigorous conditions for extracting carbon and nitrogen.

Exeter Analytical is a company specializing in the manufacture of elemental analyzers. We can provide support and advise on all application areas and we run a CHN/O/S application laboratory to assist you in getting the best results on your samples.

Principles of Operation

The samples to be analyzed are weighed into disposable tin or aluminum capsules. The sample is injected into a high temperature furnace and combusted in pure oxygen under static conditions. At the end of the combustion period, a dynamic burst of oxygen is added to ensure total combustion of all inorganic and organic substances. If tin capsules are used for the sample container, an initial exothermic reaction occurs raising the temperature of combustion to over 1800°C.

The resulting combustion products pass through specialized reagents to produce from the elemental carbon, hydrogen, and nitrogen; carbon dioxide (CO_2), water (H_2O) and nitrogen (N_2) and N oxides. These reagents also remove all other interferences including halogens, sulfur, and phosphorous. The gases are then passed over copper to scrub excess oxygen and reduce oxides of nitrogen to elemental nitrogen. After scrubbing, the gases enter a mixing volume chamber to ensure a homogeneous mixture at constant temperature and pressure.

The mixture then passes through a series of high-precision thermal conductivity detectors, each containing a pair of thermal conductivity cells. Between the first two cells is a water trap. The differential signal between the cells is proportional to the water concentration, which is a function of the amount of hydrogen in the original sample. Between the next two cells is a carbon dioxide trap for measuring carbon. Finally, nitrogen is measured against a helium reference.

Sulfur is measured separately, as sulfur dioxide, by replacing the combustion and reduction reagents. Oxygen is also measured separately by pyrolysis in the presence of platinized carbon. The oxygen is finally measured as carbon dioxide. Both analyses are easily carried out and require a simple change of reagent tubes. In this way the analysis of either sulfur or oxygen is not compromised by trying to determine several elements at the same time. Parameters and reagents are optimized for the element undergoing analysis.

SPECIFICATIONS

Accuracy: With standard organic compounds, +/-0.15% absolute plus +/- 0.15% relative
Sample Size: Typically 1-5 mg; up to 500 mg for samples with low carbon content

Analysis Time: Less than 5 minutes for CHN

Controller: IBM-Compatible PC with Windows/Windows 95

Automation: 64 sample carousel, OR, single sample with ability to re-weigh for ash

Range: 100 ppm to 100%

Detector: Thermal conductivity

System Sensitivity: +/- 1 microvolt

Analytical Sensitivity: Less than 1 microgram

Power: 110/220 V, 60/50 Hz, 10 amp, single phase

Weight: 125 lbs. / 57 kg.

Dimensions: 32" wide x 28" deep x 13" high (81 x 71 x 33 cm)

Bottled Gases Required: Helium/Oxygen 99.99% purity